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ABSTRACT

In the winter of 1999, the Southern Regional Education Board's (SREB's) Educational Technology Cooperative analyzed technology equipment standards and guidelines from state departments of education and higher education agencies in the SREB states. This report, which is based on a summary of these guidelines and standards, reflects the Educational Technology Cooperative's perspective on what constitutes good decision-making regarding technology equipment. It provides schools and campuses with reliable, up-to-date information about technology equipment from a regional perspective. The first section presents an overview of the type of computer technology required for a well-equipped school or campus in 1999-2000. The remaining sections discuss: work-station configurations; local area networking (LANs); network operating systems and servers; connecting LANs to wide area networks (WANs); electronic mail; other technical considerations; and associated planning activities. Several appendixes include the following: excerpted paragraphs from "Vision for Technology Infrastructure, Appendix B.1" from the "Louisiana State Plan for Educational Technology"; important operational considerations; preferred minimum PC (compatible with Microsoft Windows) and Apple Macintosh configurations; Ethernet technology and network management and configurations; state education agencies with equipment standards or guidelines; essential technical guidelines for within building networks; and a glossary of technical terms. (AEF)

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Guidelines for Technology Equipment Selection and Use:

An SREB Model for Schools and Campuses

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Guidelines for Technology Equipment Selection and Use:

An SREB Model for Schools and Campuses

Introduction

Careful planning by schools and colleges in selecting and purchasing technological equipment is important. While funding for technology equipment has increased in recent years, there is never enough to meet all the needs of schools and campuses. School or campus administrators often are expected to make purchasing decisions in a short time. These purchasing decisions may be extremely difficult, given the technical and often complex nature of technology. Resources such as state specifications quickly become outdated because of rapid changes in technology, and fluctuations in prices can make identifying the "best price" difficult.

SREB states address equipment issues through several avenues, including product evaluations, equipment guidelines, recommended purchasing lists and state equipment contracts. States promote the benefits of equipment compatibility across the state and encourage institutions to standardize technology equipment, but they generally do not prescribe equipment specifications. In each state, various agencies may be responsible for different parts of the technology puzzle, and inconsistent recommendations result.

Thirteen agencies for higher education and elementary and secondary education have established statewide **standards** for computer or technology equipment, and 19 agencies provide schools or campuses with technical equipment **guidelines**. For example, the West Virginia Governor's Office of Technology has developed guidelines for use by the Department of Education and other K-12 and higher education agencies. The Tennessee Department of Education, which originally had detailed equipment specifications for its *21st Century Classrooms*, has moved away from this level of detail and applies manufacturers' specifications in its statewide contracts. The Kentucky Office of Postsecondary Education expects to provide guidelines rather than mandated standards. And the Mississippi Department of Education updates its statewide standards once a year.

In the winter of 1999, the Southern Regional Education Board's Educational Technology Cooperative analyzed technology equipment standards and guidelines from state departments of education and higher education agencies in the SREB states. This report, which is based on a summary of these state guidelines and standards, reflects the

Educational Technology Cooperative's perspective on what constitutes good decision-making regarding technology equipment. It provides schools and campuses with reliable, up-to-date information about technology equipment from a regional perspective. As a result, K-12 and postsecondary administrators and managers are better able to sort through the array of technologies and prices available and make informed decisions about selection and purchasing.

Because technology uses and equipment change so rapidly, an annual guideline report is planned. This report is "Version 1.0." Technical terms that are essential to describing certain technology applications are listed in a glossary of terms in Appendix G.

A. General Recommendations

This section presents an overview of the computer technology required for a well-equipped school or campus in 1999-2000. These general recommendations address the *types of technology needed,* as opposed to more detailed equipment guidelines that likely will change rapidly and will be influenced by many local factors.

1. Schools and campuses should install communications wiring to accommodate a local area network (LAN) throughout a single building, the campus or the district. This network should be used for both instructional and administrative support.

2. All administrative and classroom computers should be connected to the LAN, which should connect to the state's educational wide area network (WAN). All SREB states have statewide educational networks in some stage. These networks enable schools and campuses to connect to national and international resources via the Internet. Until schools and campuses have Internet connections through their local networks, they may need to establish direct connections through a local Internet services provider (ISP). *Telecommunication's Status, Trends and Issues in the SREB States* (SREB Educational Technology Cooperative, 1997) provides references about LANs and WANs and their connection to the Internet. Two other SREB reports on statewide educational networks — *An Educational Network Study in Three States: Success Factors and Issues* and *Statewide Educational Networks: Policy and Management Report* — provide critical analyses of essential factors in making decisions about statewide networks.

3. For administrative use, each school or campus should have at least two networked computers dedicated to providing staff with adequate access to the system and to providing backup to ensure continuous access; one networked printer; and appropriate management software for administrative and instructional purposes.

4. Classrooms should have late-model networked computers for student use, and there should be a suitable ratio of computers to students. A minimum of one computer for every five students is essential to meet students' needs.

5. Each networked computer should contain a CD-ROM or DVD device and should be accompanied by a printer, projection system for group activities, appropriate furniture, and licensed software for instruction, administration and e-mail. Following the guidelines listed above regarding school LAN/WAN/Internet connections will offer every classroom access to the Internet.

6. Network connection is especially important in the library or media center, where the Internet and other electronic sources are needed for student research. Media centers in schools and on campuses increasingly incorporate today's technology and automation services to prepare students for the world of work and to equip them to access, evaluate and use information. Automation of a media center includes online access to research materials and the Internet, library catalog, circulation, inventory and administrative reporting.

7. Overall network capabilities — LAN servers, gateways to and from external networks, file transfer services, and e-mail services — should be integrated to ensure that a single network has access to all instructional and administrative applications.

8. As campuses and schools are networked, it is vital to determine whether existing *electrical* wiring should be expanded and/or updated to provide the required quantity and quality of power at all equipment locations. A complete analysis of the electrical distribution system also should consider surge protection, uninterruptible power supplies (UPS) and lighting.

9. Successful educational computing and networking relies on the availability of training and technical support. Schools and campuses should be well-informed on the services available from local and state agencies. Depending on support provided by a particular state or school district, schools may need to arrange for additional technical assistance through local businesses. Such consulting and trouble-shooting services generally will be much more valuable if provided by an organization that is familiar with the educational environment and with the LANs and WANs used by the schools.

B. Work-station Configurations

Six SREB states maintain specific and current specification guidelines regarding technology equipment. A good example is Georgia, where both the University System Chancellor's Office and the Department of Education post regularly updated guidelines on their Web sites. In most states' technology guidelines almost all the basic work-station attributes are similar. However, hardware is improving so rapidly that the consensus recommendation for PCs may be characterized in this rather simple manner: Buy the most powerful processor, memory and disk storage that are widely available from multiple vendors, without paying a premium price for less-common or top-of-the-line performance (such as for a very new chip that is not yet commonly used for mass retail-market products).

Also consider the following:

- Avoid discontinued models.
- It is important for anyone who considers buying equipment that is not made by a leading manufacturer to compare its capabilities with those of leading vendors' *current* products. Be wary of seemingly good deals from local vendors who assemble their own systems.
- When selecting vendors, it is essential to arrange for equipment maintenance, preferably on-site maintenance. Maintenance arrangements will reflect the availability of local repair services, which will be limited in small towns and rural areas.
- As the cost of computers drops, many buyers will consider purchasing computers that sell for $1,500 or less. While these may be quality computers that will meet school and campus requirements, make sure that they are not simply entry-level machines that lack expandability. Buying such computers may be an appropriate short-term solution, but schools and campuses must consider this issue or they may end up with an inventory of outdated equipment.
- An important alternative to the type of work stations described above (PCs that have substantial stand-alone capabilities) is that of "network devices." These machines have limited configurations with minimal storage because they depend on network access to servers (see Section D). They are much less expensive and therefore may become increasingly popular. One disadvantage is the machine's heavy dependence on the local area network (see Section C), which must be available and reliable at all times; if the LAN is down, the network devices are essentially useless for most applications. These cheaper, scaled-down work stations therefore may be more practical for schools and campuses that already have LAN experience and the in-house expertise to maintain such facilities reliably.

Some SREB states rely on master contracts established for statewide purchasing to provide guidance in the purchase of technology equipment. While these recommended (or required) minimum specifications may be helpful, equipment purchases should be based on specific planned uses for the equipment.

C. Local Area Networks (LANs)

Local area networks are used to connect computer equipment — such as work stations, servers and printers — on a particular campus. Besides providing connectivity among computers and other resources locally, the LAN also typically provides the connection to a statewide wide area network (WAN) and, through the WAN, to the outside world. Proper design and installation of the LAN is therefore critical to the successful use of technology in

the classroom. Computers and printers should be purchased "network-ready" because it can be costly to add this capability later.

It is extremely important to select LAN equipment and wiring that conform with the applicable national or international standards. While these standards are not specific to education, they are generally applicable. Schools should have no trouble finding wiring contractors who are familiar with the standards. The person selected to install the LAN wiring must be a well-qualified contractor who also appreciates how school and campus environments differ from the commercial sector and is familiar with educational applications and the associated requirements.

The wiring to support communications is a long-term investment. Properly installed wiring will support the school's needs for a relatively long time. Initial planning during building design and construction will result in substantial long-term savings. All new projects should take into account installation of wire, fiber and conduit; adequate electrical service; and sufficient electrical outlets and network jacks. Cost-cutting in networking capability during construction may appear desirable initially but will cost up to four times as much in the long run. Wiring and related components should be based on a structured network plan equipped to support data, voice and video needs. Essential technical guidelines for networks *within buildings* appear in Appendix F.

For network connections between buildings, fiber-optic cable is the preferred choice. If this option is too costly, then 10Base-T wiring may be used, at least for the first few years (assuming that it meets the particular school's initial capacity requirements). However, using copper wire between buildings can result in serious damage during electrical storms, so copper wire should not be used if an alternative is available. If copper is used, it is wise to install lightning arrestors. Fiber-optic cable would provide much higher capacity *within* a building, but that level of capability probably would not be needed for some time.

D. Network Operating Systems and Servers

Servers and work stations for students and faculty should be connected to the LAN. The servers will provide centralized, high-capacity storage and software libraries; e-mail; and shared access to printers. A network operating system, running on a file server, will be required to manage the resources on the network. Schools and colleges should select one of the two network operating systems that are used widely in the market today: Microsoft's Windows NT or Novell NetWare (version 4.x or higher). These systems run on hardware platforms that are essentially high-end work stations and are available from most computer vendors. It may be wise to select the same vendor for student work stations and file servers to ensure compatibility and technical service.

UNIX systems often are used (especially in higher education) for Web and e-mail servers. However, these systems are typically complex and require substantial staff expertise in the UNIX operating system.

E. Connecting LANs to Wide Area Networks (WANs)

Each district or multicampus institution may want to install its own WAN. One site should be designated as the central control point for the WAN. The district or campus WAN then could connect to a statewide WAN and through that to the Internet. System architecture and communication "protocols" will vary greatly by state, although TCP/IP has become the industry standard. Connecting to a statewide WAN requires close coordination with the state agency that operates the network. That agency also will advise districts and schools about the specific type of equipment required for connecting and working in the network. Because compatibility is critical, local schools and campuses must follow the recommendations of the central network agency or organization. States may need to have regulations requiring that such procedures be followed.

Connecting to WANs requires additional equipment, such as routers and Data Service Unit/Channel Service Units (DSU/CSUs). The agency that operates the WAN typically places routers, such as those manufactured by market leader Cisco, on state contract. Schools and campuses generally should select (and may be required to select) the same vendor that provides similar equipment statewide to users of the common WAN. Schools and campuses should ask their state's network operator for state-specific advice on all matters of WAN connection.

F. Electronic Mail

Electronic mail (e-mail) has become essential for communication both within schools and campuses and with the national/international community. This service may be provided either locally or through a remote supplier. Local e-mail facilities often are associated with LANs and their operating systems. Local e-mail protocols may not be compatible with those used on the Internet, where the standard is called SMTP. A good local e-mail product, if it is not SMTP-based, should include a "gateway" to SMTP for use with the Internet. *No e-mail system should be adopted that does not provide for message exchange with the national/international community. Such a system soon would need to be replaced, resulting in additional costs and retraining for all users.*

Agencies that operate statewide WANs can provide schools and campuses with good information about in-state suppliers of SMTP e-mail. WAN and e-mail services should be coordinated and closely linked whenever possible.

G. Other Technical Considerations

1. The new networked environment may require schools' and campuses' existing computers to be upgraded in order to provide faster processing; larger memory and storage capacities; and the CD-ROM, sound and graphics capabilities associated with multimedia.
2. It also may be desirable to have TV and VCR resources suitable for classroom use; a closed-circuit TV system with connection to external video sources; broadcast video; or a digital (Ku Band) satellite system.
3. Cable TV (CATV) is an alternative for high-speed connection to the Internet in a growing number of areas. However, local policy may require connection to a statewide, government-operated WAN that also provides connections to the Internet. Schools should consult the appropriate agency in their state before arranging Internet service through local CATV providers.
4. Like all other students, those with special needs should have regular access to computer systems to support learning in core subjects. Specialized equipment should be included to accommodate these students' specific physical and learning disabilities.
5. Work-station configuration and proper seating are important considerations to avoid physical injury. As technology use expands, schools and campuses need to address ergonomics and repetitive stress injuries.
6. The recommended infrastructure should provide sites for training teachers and opportunities for students to access technology in the classroom. It also should allow student records to be shared among teachers and other instructional managers.
7. Privacy protection should be considered to prevent inappropriate use of or access to information.
8. Each school should have at least one location with several networked computers for training activities. These training/lab facilities also might include imaging devices, such as scanners and digital cameras, for instructional material and course development. All classrooms and labs should have at least one printer.
9. Facilities should have adequate space available to use desired technologies and the appropriate climate control for the anticipated equipment.
10. Practices and procedures for network operations should be considered during the planning process (see Appendix B).

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H. Associated Planning Activities

Planning for technical infrastructure is an essential first step toward meeting each school's basic technological needs. Such planning could include:

- assessing the current infrastructure and identifying each school's current and future needs;
- developing a district plan that indicates which benchmarks already have been achieved and plans how to reach other benchmarks;
- including in an overall district plan for technology a plan for establishing technological infrastructure;
- investigating the state's purchase options; and
- leveraging purchasing power by buying as a group on a local, state or regional level.

References and Acknowledgments

States throughout the SREB region contributed information from their technology plans or other documents for the development of this report. Information from the following documents was especially useful. Readers may wish to review some of these documents for additional details and general discussion. Publication dates are extremely important, because certain specific recommendations about technology may have been updated.

1. *Louisiana State Plan for Educational Technology, Appendix B: Technology Infrastructure and Resources.* http://etrc33.usl.edu/state/app-b.htm
2. *Technical Specifications* of the Mississippi Department of Education *(originally* Appendix D of the Mississippi *Master Plan for Educational Technology).* http://mdek12.state.ms.us/minspecs.pdf
3. *Express Products List,* Mississippi Department of Education. http://www.its.state.ms.us
4. *South Carolina Educational Technology Plan,* "Systems and Support," especially the discussion of "Connectivity/Network Design." This document includes tutorial information that could be helpful to some readers. http://www.state.sc.us/sde/educator/techplan/techsupp.htm
5. *Information Technology Resource Management Guideline* of the Virginia Council of Information Management, COV ITRM Guideline 95-1 on local area networks, 1995.
6. *Microcomputer Recommendations for New Purchases,* Board of Regents, University System of Georgia. http://www.peachnet.edu/oiit/support/pc/microcomp-rec.html

7. *FY99 Classroom Technology Project,* Appendices C and E, Georgia Department of Education.

8. *State-of-the-Art Computer Specifications,* Oklahoma Department of Vocational and Technical Education, July 1998.

9. *Building and Wiring Checklist and Explanation,* Kentucky Department of Education, 1994. http://www.kde.state.ky.us/default.asp?m=63&i=1128

Appendix A

The following excerpted paragraphs from *Vision for Technology Infrastructure, Appendix B.1* from the *Louisiana State Plan for Educational Technology* are provided as an example for statewide network planning.

"The *Louisiana State Plan for Educational Technology* recommends achieving statewide equitable and reliable school access to computer-based information, multimedia, calculators, satellite, and broadcast resources with continuing technical assistance and instructional support in uses of those technologies to enhance teaching, learning, and administration. The initial thrusts of this plan are to provide technology infrastructure for each Louisiana school and training for every teacher, producing access for every student to technology and to the advantages that competence in using technology can bring to them. It is recommended that all schools be equipped to accommodate technology-rich learning environments designed to support both the teaching and learning process and the instructional management needs of the District/schools.

"To ensure equity of access to technology for every student during the regular schooling process, the State of Louisiana must make the commitment to its citizens to provide a technology infrastructure, training, and staffing to support the use of technology in teaching, learning, and instructional management. Basic technical infrastructure can be provided to every school over a five-year period.

"Critical to the success of a plan for providing technology to support learning for all students is the training of all teachers in the uses of technology for teaching, learning, and student instructional management. To do so, training sites must be established that reflect the platforms and software to be used in each school; each teacher must have a system in their own classroom; and that teacher must be connected to the instructional management centers of their school to share student records. The classroom system will also allow teachers to begin introducing students to technology resources. Once teachers are trained and students are provided an initial introduction to technology resources, the demand for additional systems to serve student needs will need to be addressed. At this point, funding to achieve a 5:1 student-to-computer ratio would allow districts to provide infrastructure to achieve equity of access to technology for every child.

"Districts will determine how the technology will be allocated within the schools, however, the district or school plan must state how equity of access for every student will be achieved with this allocation of equipment. Whether the additional computers are in labs, mini-labs, classrooms, the District/school plans must state how each student, including those with special needs, will have access to technology.

"Long-range plans for ongoing enhancement of existing technology infrastructure, training, and maintenance/replacement of hardware and software must be developed. Hardware usability must be assessed to determine if students with special needs or courses

requiring special technology are being served with the technology currently available. A plan for acquisition of assistive hardware, labs for computer science/computer literacy courses, and other devices to support learning, such as graphing calculators, videoconferencing facilities, science probes, etc., and for maintaining and replacing hardware and software regularly must be developed."

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Appendix B

Operational Considerations

Selecting work stations, servers and a LAN is only the beginning. Attention must be given to operational practices, and planning should begin while the network is being designed. Although such matters are basically beyond the scope of this document, a few important topics are listed below to illustrate the kinds of issues that must be addressed. Some of these have implications for staffing.

1. Backup for disk drives on work stations: The LAN will make it possible to back up local hard drives on central servers or on tape-based devices.
2. Backup for servers: Servers also must be backed up, especially when student records and financial data are stored there.
3. Physical security: Depending on general access to the building and building security, there may be a need to lock down work stations so they cannot be removed easily from the premises. (Network equipment should be in a more secure location, such as in a locked closet.)
4. Network security: Steps must be taken to prevent unauthorized access (via the LAN) to student records, financial data, etc. Unauthorized access via the Internet may be an issue, depending on the nature of the Internet connection.

Appendix C

Preferred minimum PC (compatible with Microsoft Windows) and Apple Macintosh configurations.

The preferred minimum PC configuration is:

- Pentium II processor (chip), 200MHz to 300MHz (or equivalent)
- 64MB RAM (processor memory) if Windows 97
- 4GB hard disk capacity
- one floppy drive, 1.44MB
- one CD-ROM (8x to 24x)
- 15-inch color monitor, capable of supporting 1024 x 768 resolution
- Ethernet interface card for 10/100Mbps

The preferred minimum Apple configuration is:

- G3 processor, 200MHz to 300MHz
- 32MB RAM
- 3GB to 5GB hard disk capacity
- one floppy drive (not available on the iMac)
- one CD-ROM
- 15-inch color monitor, capable of supporting 1024 x 768 resolution

The specifications listed above are *minimum* standards that are associated with current software requirements in most states. Higher-performance machines will be better prepared for future software (particularly multimedia applications) and will have longer useful life-times.

Appendix D

Ethernet technology and network management and configurations

1. *Connecting Learners: South Carolina's Educational Technology Plan,* "Systems and Support: Connectivity/Network Design" (South Carolina Department of Education, 1999). http://www.state.sc.us/sde/educator/techplan/techsupp.htm#II.Connectivity /Network Design

2. *Louisiana State Plan for Educational Technology, Appendix B.4,* "Illustrations of Technology Infrastructure for Schools" (developed September 1996) and *Appendix B.3,* "Louisiana District Networking Model" (developed by Louisiana Department of Education–MIS, revised July 1997). http://etrc33.usl.edu/state/app-b.html#B1

3. *1998/2000 Update Kentucky Master Plan for Education Technology,* "The Infrastructure: Networks and Access" (Kentucky Department of Education, 1998).
   The *Master Plan for Education Technology* calls for an integrated network for voice, video and data to link the state Department of Education and all schools, classrooms, district offices and regional service centers with other partners in education. It also calls for equitable access to various instructional and administrative services to be delivered through the network to computers in every classroom and administrative office. http://www.kde.state.ky.us/bmss/oet/dpp/MP98.html#infrastructure

4. *Technology Models: Campus Infrastructure Model Version: 1.0* (Virginia Community College System, 1999) includes detailed recommendations for classroom and campus configurations, including network applications and security. http://www.so.cc.va.us/its /models/cim.htm

Appendix E

States with equipment standards or guidelines

State agency	Does your state or agency have equipment standards established for computer and other technologies?	Does your agency provide schools/campuses with guidelines or recommendations for computer equipment and other technologies?	Web addresses for standards or guidelines
Alabama Commission on Higher Education	No	No	Not applicable
Alabama Department of Education	No	Yes	Not available online
Arkansas Department of Education	No	No	Not applicable
Arkansas Department of Higher Education	No	In some cases	Not available online
Delaware Department of Education	Delaware does not mandate computer and technology purchases. The state encourages the purchase of name-brand equipment through a state bid list.	The Delaware Department of Education has a recommended configuration that many districts use as a guideline.	http://www.state.de.us/purchase/assets/images/99041JS1.pdf http://www.doe4.state.de.us/doe_pc/dpi_comp.htm
Delaware Higher Education Commission	No	No	Not applicable
Florida Department of Education	Yes	No	http://www.state.fl.us/dms/orgdocs/support.html; http://www.state.fl.us/dms/divcom/peer-peer.htm
Florida Board of Community Colleges	No	No	Not applicable
Florida State University System	The Florida Distance Learning Network (FDLN) provides a technical guide that outlines basic equipment needs for participants in FDLN.	No	http://www.gc.cc.fl.us/fdln/ttfappa.htm

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States with equipment standards or guidelines – continued

State agency	Does your state or agency have equipment standards established for computer and other technologies?	Does your agency provide schools/campuses with guidelines or recommendations for computer equipment and other technologies?	Web addresses for standards or guidelines
Board of Regents, University System of Georgia	Guidelines only	Yes	http://www.peachnet.edu/oiit/pubs/rec97/index.html
Georgia Department of Education	Yes	Yes	http://www.doe.k12.ga.us/technology/guidefinal.pdf.
Kentucky Department of Education	Yes. All contracts are arranged through bids based on architectural standards.	Yes	http://www.kde.state.ky.us/default.asp?m=57 http://www.kde.state.ky.us/default.asp?m=63 http://www.kde.state.ky.us/default.asp?m=58
Kentucky Council on Postsecondary Education	Not at this time but may in future; may take form of guidelines rather than mandates.	Not at this time but may in future; may take form of guidelines rather than mandates.	Not applicable
Louisiana Board of Regents	Yes	Yes	Not available online
Louisiana Department of Education	Yes	Yes	http://etrc33.usl.edu/state/app-b.html#B2
Maryland Department of Education	Yes	Yes	http://www.dbm.state.md.us/html/compare.html
Maryland Higher Education Commission	No	No, but the state is moving in that direction.	Not applicable
Mississippi Department of Education	Yes	Yes. The specifications are updated once a year.	http://Mdek12.state.ms.us/plan.htm
Mississippi Institutions of Higher Learning	Yes. The state's small set of standards is to ensure reliable connectivity to the statewide data and video networks. When possible, the standards are not vendor-specific. But the set of standards is required. There are no standards recommended or required for hardware or software not related to network compatibility.	Yes, for items that must be compatible to operate on the state data and video networks.	http://www.its.state.ms.us

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States with equipment standards or guidelines – continued

State agency	Does your state or agency have equipment standards established for computer and other technologies?	Does your agency provide schools/campuses with guidelines or recommendations for computer equipment and other technologies?	Web addresses for standards or guidelines
North Carolina Department of Public Instruction	Statewide technical standards for infrastructure	Yes	http://www.state.nc.us/IRM/techarch/archfrm.htm http://www.state.nc.us/irm/ACTIVITI/schltch2/techfin.htm
University of North Carolina General Administration	No	Yes	http://www.doa.state.nc.us/PandC/204a.htm http://www.doa.state.nc.us/PandC/250over.htm
North Carolina Community College System	Statewide technical standards for infrastructure	Yes	http://www.state.nc.us/IRMC/documents/approvals/
Oklahoma Regents for Higher Education	No	No	Not applicable
Oklahoma Department of Education	No	Yes	Not available online
Oklahoma Department of Vocational and Technical Education	Yes	Yes	Not available online
South Carolina Commission on Higher Education	No	No	Not applicable
South Carolina Department of Education	Yes, recommended in the state technology plan.	Yes, for specific projects (such as the administration package for schools). Other recommendations are in the state technology plan.	http://www.state.sc.us/sde/educator/techplan/
Tennessee Department of Education	The state had very specific standards for *21st Century Classrooms* but has found it necessary to be more flexible.	Yes	http://www.state.sc.us/
Tennessee Higher Education Commission	No	No	Not applicable

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States with equipment standards or guidelines – continued

State agency	Does your state or agency have equipment standards established for computer and other technologies?	Does your agency provide schools/campuses with guidelines or recommendations for computer equipment and other technologies?	Web addresses for standards or guidelines
Texas Education Agency	Yes, for networking applications.	The Long-Range Plan for Technology 1996-2010 offers guidelines regarding infrastructure and other technologies and includes minimum hardware requirements.	http://www.state.tx.us/Standards/
Texas Higher Education Commission	No	No	Not applicable
Virginia Department of Education	No	Yes	Not available online
Virginia Community College System	Yes	Yes	http://www.so.cc.va.us/its/guidelines/index.htm
Council for Higher Education in Virginia	Yes	Yes	http://www.cim.state.va.us/Pubs/cim-pubs.htm; http://www.cim.state.va.us/Pubs/cimpubs.htm#Standards
West Virginia Governor's Office of Technology	Yes — recommended but not required.	Yes	http://www.state.wv.us/itc/std_html/std_toc.htm
West Virginia Department of Education	Yes. Minimum specifications are incorporated into bid and contract documents.	The department follows recommended guidelines provided by the Governor's Information Technology Council.	http://www.state.wv.us/itc/std_html/std_toc.htm
West Virginia College & University System	Yes — recommended but not required.	The system follows recommended guidelines provided by the Governor's Information Technology Council.	http://www.state.wv.us/itc/std_html/std_toc.htm

Note: Standards may be state requirements, such as those specified in contracts. Guidelines are usually suggestions.

Source: SREB analysis of surveys of state education agencies, 1999.

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Appendix F

Essential technical guidelines for within building networks

- "Unshielded twisted pair" (UTP) wiring should be used, at least for schools and campuses installing their first LANs.
- The prevailing standard for such copper-wire cabling is "10Base-T" with a quality grade of at least EIA Category 5.
- Cabling should be terminated in multiple RJ45/48-type jacks.
- Ethernet is the most common communications protocol, and the standard associated with it is IEEE 802.3.
- A speed of 10Mbps may be adequate for new LANs. However, Category 5 cable, with higher-performance equipment, will enable speeds of 100Mbps. Upgrade capability is important so that the school can use the same wiring for 100Mbps Ethernet.
- Each building should designate a communications closet (room) to house network equipment. This closet should be fully climate-controlled, should have a dedicated telephone line and should provide clean, *interference-free* electrical service.

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Appendix G

Glossary of Technical Terms

Conduit — A pipe, usually metal, that runs either from floor to floor or along a floor or ceiling to protect cables. City building and fire codes often require conduits to be metal.

DSU/CSUs (Data Service Unit/Channel Service Units) — Devices used to access digital data channels at both ends of communicating equipment.

Ethernet — A very common method of networking computers in a LAN. Ethernet will handle about 10 million bits per second and can be used with almost any kind of computer.

Ku Band — Portion of the electromagnetic spectrum in the high microwave range (10.9GHz to 36GHz) used for satellite transmission.

Mbps — Megabits per second (1 million bits per second). A measurement of how fast data is moved from one place to another. A set of bits represents a single character. Usually there are eight bits in a byte. One megabyte is 1 million bytes (8 million bits). A 28.8 modem can move 28,800 bits per second.

Network jacks — A wall-mounted connection device, similar to those used for telephones, into which network cable is plugged.

Protocol — A standard for communication between computers and communications devices.

Server — A computer or a software package that provides a specific kind of service to *clients* software running on other computers. The term can refer to a particular piece of software, such as a *file server,* or to the machine on which the software is running (e.g., "Our mail server is down today; that's why e-mail isn't getting out."). A single server machine could have several server-software packages running on it, thus providing many different servers to "clients" on the network.

SMTP (Simple Mail Transport Protocol) — The main protocol used to send electronic mail on the Internet. SMTP consists of a set of rules for interaction between a program sending mail and a program receiving it. Almost all Internet e-mail is sent and received by *clients* and *servers* using SMTP. If one wanted to set up an e-mail server on the Internet, one would look for e-mail software that supports SMTP.

TCP/IP (Transmission Control Protocol/Internet Protocol) — A data-communications protocol used by many operating systems and hardware platforms that allows different equipment to communicate and share data.

Unshielded twisted pair (UTP) — A cable medium with at least one pair of twisted, insulated, copper conductors bound in a single plastic sheath. UTP wiring is the most common method of bringing telephone and data services to the desktop.

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